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# **PUBLICATIONS AND PATENTS**

**July-December 1974**

**Agricultural Research Service  
U.S. DEPARTMENT OF AGRICULTURE**

U.S. DEPARTMENT OF AGRICULTURE

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Northern Regional Research Laboratory  
Agricultural Research Service  
United States Department of Agriculture  
1815 North University Street  
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## REQUEST FOR INFORMATION

Results of research investigations at the Northern Regional Research Laboratory are published regularly in the technical literature, and public-service patents are secured to cover patentable inventions and discoveries (see page 56). As a convenient guide to our publications and patents, a list with abstracts is published semiannually. These abstracts describe the current research and indicate the progress achieved. Further information on any of the developments, as well as earlier technical papers, may be obtained by writing us.

In conformance with the policy of the U.S. Department of Agriculture, Northern Laboratory publications are available to scientists and other specialists, librarians, representatives of the press, and others interested.

Reference to commercial equipment or proprietary products is made as part of the exact experimental conditions. Naming a company or product does not imply approval or

recommendation by the U.S. Department of Agriculture over others not mentioned.

Requests for specific reprints should be by number and addressed to the Northern Regional Research Laboratory. Those titles marked with an asterisk [\*] are not available at the Northern Laboratory for distribution.

Most of the publications are in journals that are available in libraries. Photographic copies of most journal articles on research at this Laboratory can be purchased from the National Agricultural Library of the U.S. Department of Agriculture, Beltsville, Maryland 20705.

No publications will be sent regularly in response to foreign requests unless exchange arrangements have been made with the Director of the National Agricultural Library.

Copies of previous lists of publications and patents are available upon request.

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## PUBLICATIONS

[Publications marked with an asterisk (\*) are not available for distribution at the Northern Regional Research Laboratory. When requesting reprints, please order by number. Use your zip code.]

- 3530 • A Taxonomic Re-Evaluation of the Round-Spored Species of *Pichia*  
C. P. Kurtzman and M. J. Smiley  
Proc. Fourth Int. Symp. Yeasts, Vienna, Austria, July 8-12, 1974,  
Pt. 1, pp. 231-232. 1974

Species of *Debaryomyces* and those of *Pichia* with round ascospores possess many similarities. One of the characteristics allowing separation of the two genera is the roughness of ascospores in the genus *Debaryomyces*. *Pichia polymorpha*, *P. pseudopolymorpha*, and *P. melissophila* were shown by scanning electron microscopy to have roughened ascospores and consequently should be transferred to *Debaryomyces*. The other *Debaryomyces*-like species of *Pichia* were shown to have smooth spores and appear to represent a discrete taxonomic group.

- 3531 • The Filler-Binder Interface in Paint Films  
R. L. Eissler, F. L. Baker, and J. A. Stolp  
Appl. Polym. Symp. No. 23: 41-48. 1974

A previously described, quantitative method for use with a scanning electron microscope (SEM) to study adhesion between filler particles and solidified vehicle matrix has been applied to four linseed oil film-pigment systems. Water sensitivity was compared of films from a bodied oil and an unbodied oil containing zinc oxide pigments with and without an organic phosphate treatment. SEM photomicrographs were taken, and the number of particles appearing in surfaces formed by tensile fracture of films were counted. After holding parameters related to the SEM and photographic exposure constant, appearance of only a relatively few pigment particles in photographs of fracture surfaces presumably meant good particle-binder adhesion. A three-way analysis of variance on geometric means of particle concentration indicated that adhesion improved in films from bodied oil and treated pigment when these films were tested dry before or after water exposure. Any similar improvement in films from unbodied oils was apparently obscured by the weak mechanical strength of the vehicle. It seems possible to modify our method so that data can be taken directly and tabulated electronically from SEM images.



3532 • Pentane Formation and Rancidity in Vegetable Oils and in Potato Chips

K. Warner, C. D. Evans, G. R. List, B. K. Boundy, and W. F. Kwolek<sup>1</sup>

(<sup>1</sup>Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)  
J. Food Sci. 39(4): 761-765. July-August 1974

Pentane formation during initial stages of autoxidation is indicative of rancidity in aged vegetable oils and potato chips. Pentane in the headspace gas of oils and chips was measured by gas chromatography. An 18-member taste panel evaluated the samples for development of rancid odors and flavors. Significant linear correlations were obtained between the amount of pentane developed and the number of rancid descriptions. Samples needed only 0.08 p.p.m. pentane in the headspace to be described as rancid by 90% of the panel. Both oils and chips were more stable to the development of pentane as the linoleate content and the iodine value decreased.

3533 • Kenaf for Pulp and Paper. Summary Statement--June 1974

[T. F. Clark]

North. Reg. Res. Lab., ARS, USDA, CA-NRRL-42, 2 pp. July 1974

Investigations on kenaf, *Hibiscus cannabinus*, at the Northern Regional Research Laboratory, Peoria, Illinois, have demonstrated that this plant species has promising potential as a fibrous raw material for the pulp and paper industry. These continuing investigations include preparatory treatments, pulping, bleaching, and papermaking. In addition, NRRL scientists are heavily involved in extensive cooperative studies of preservation techniques and are helping to coordinate these with harvesting studies by agricultural engineers.

3534 • Aflatoxin M<sub>1</sub>: Analysis in Dairy Products and Distribution in Dairy Foods Made from Artificially Contaminated Milk

Robert D. Stubblefield and Gail M. Shannon

J. Ass. Off. Anal. Chem. 57(4): 847-851. July 1974

A published method to determine aflatoxin M<sub>1</sub> in fluid and concentrated milks was refined to permit assays of a wider range of dairy products. Milk products that were spiked with aflatoxin M<sub>1</sub> were processed with commercial dairy cultures, rennet, and organic acids to make several cheeses and butter. Cheeses that were representative of various curd-precipitation methods or high cooking temperatures were included. When milk was set with lactic acid cultures and small quantities of rennet to produce short-set cottage cheese or heated with lactic acid starter to prepare Ricotta cheese, some 71-74% of the aflatoxin M<sub>1</sub> was recovered in the whey fractions. Nearly equal quantities of M<sub>1</sub> were detected in curds and whey from long-set, acid-precipitated cottage cheese and from rennet-precipitated cheeses, such as Colby, Cheddar,

and Swiss. Results were similar with Queso Blanco cheese products that were produced by direct addition of organic acids. According to analysis, only 16% of the available  $M_1$  was in the butter while the remainder was in the buttermilk.

- 3535 • Collaborative Study of Methods for the Determination and Chemical Confirmation of Aflatoxin  $M_1$  in Dairy Products  
Robert D. Stubblefield and Gail M. Shannon  
J. Ass. Off. Anal. Chem. 57(4): 852-857. July 1974

An international collaborative study involving 19 collaborators was conducted to test methods for the determination and chemical confirmation of aflatoxin  $M_1$  in dairy products. For the quantitative method, collaborators assayed samples of liquid and powdered milk, cheese, and butter containing low levels of  $M_1$ . Statistical results indicated that sensitivity and precision of this method were comparable to other AOAC methods for aflatoxin  $M_1$ . Impurities were present in blue cheese extracts that tended to interfere with thin-layer chromatography. Analysis of liquid milk samples from different areas revealed that some milk extracts may require column chromatography. For the chemical confirmatory method, collaborators prepared acetate and hemiacetal derivatives of  $M_1$  in extracts of liquid milk and Colby cheese. A sensitivity limit of 30 ng  $M_1$  was apparent for the method, and most collaborators easily identified the derivatives. As a result of this collaboration, both methods are recommended as official first action AOAC methods.

- 3536 • Physiology of Sporeforming Bacteria Associated with Insects: Minimal Nutritional Requirements for Growth, Sporulation, and Parasporal Crystal Formation of *Bacillus thuringiensis*  
Kenneth W. Nickerson and Lee A. Bulla, Jr.  
Appl. Microbiol. 28(1): 124-128. July 1974

A defined medium is described in which 18 strains of *Bacillus thuringiensis* representing the 12 established serotypes grow, sporulate, and produce a parasporal crystal. This minimal medium contains glucose and salts supplemented with either aspartate, glutamate, or citrate. These organic acids are required and cannot be replaced by vitamin mixtures or succinate even though succinate is taken up at a rate similar to that of aspartate, glutamate, and citrate.



- 3537 • Physiology of Sporeforming Bacteria Associated with Insects:  
Radiorespirometric Survey of Carbohydrate Metabolism in the  
12 Serotypes of *Bacillus thuringiensis*  
Kenneth W. Nickerson, Grant St. Julian, and Lee A. Bulla, Jr.  
Appl. Microbiol. 28(1): 129-132. July 1974

Primary pathways of glucose catabolism were compared by radiorespirometry in 18 strains of *Bacillus thuringiensis* representing the 12 established serotypes. Every strain utilizes the Embden-Meyerhof-Parnas (EMP) pathway almost exclusively; the pentose-phosphate pathway participation is minor. The EMP pathway predominates regardless of whether the cells are grown in a minimal medium or one containing yeast extract. The absolute requirement for citrate and related compounds is not a result of defective citrate or glucose transport and metabolism.

- 3538 • Sweeteners in Perspective  
G. E. Inglett  
Cereal Sci. Today 19(7): 258-261, 292-295. July 1974

The need for a safe, nonnutritive sweetener for the diabetic and the diet-conscious has spurred research in many diverse areas, such as the physiological basis of sweetness and the wide variety of chemicals that evoke a sweet taste. Sweet taste is a gustatory response evoked by substances on taste buds that transmit a message to the brain indicating sweetness. The chemical nature of various substances that excite a sweet taste has been extensively studied with no universally accepted explanation. Since intensely sweet protein sweeteners act directly on taste buds as a probe, a peptide linkage analogous to the aspartic acid sweeteners may be partly responsible for their sweetness. As an extension of the probe theory, chemical structures were examined of intense glycosidic sweeteners--stevioside, glycyrrhizin, osladin, and the dihydrochalcones. The obvious similarity among these intense sweeteners is the occurrence of a (1'→2)-oxygen-linked disaccharide attached to an aglycone.

- 3539 • Fat Content in Corn Grits: Effects of Grinding, Extraction  
Solvents, and Analytical Methods  
J. E. McGhee, L. T. Black, and O. L. Brekke  
Cereal Chem. 51(4): 472-477. July-August 1974

Yellow brewers' grits ground to different particle sizes were extracted from 2 to 16 hours with pentane-hexane, diethyl ether, or carbon tetrachloride. For comparative purposes, fat content of the grits was determined also by acid hydrolysis and by an extraction-transesterification procedure wherein the extract was analyzed by gas-liquid chromatography. Particle size strongly influenced the reported fat content regardless of method of analysis or extraction solvent used. Standardization of the grinding and analytical procedure would provide a basis for direct comparison of reported fat contents of brewers' grits.

- 3540 • Aflatoxin: Distribution in Contaminated Corn  
 O. L. Shotwell, M. L. Goulden, and C. W. Hesseltine  
 Cereal Chem. 51(4): 492-499. July-August 1974

Individual kernels with the bright greenish-yellow fluorescence associated with the presence of aflatoxin and kernels without the fluorescence from contaminated white and yellow corn samples were assayed individually. Some kernels having the greenish-yellow fluorescence under the seed coat had to be split open before the typical fluorescence became visible. All fluorescing kernels contained aflatoxin; none of the nonfluorescing ones did. The following fractions from 10 lots of aflatoxin-contaminated corn were analyzed: (a) Fluorescing intact kernels and pieces; (b) kernels with fluorescence visible under the seed coat; (c) damaged, cracked, or discolored kernels, or in any combinations; and (d) outwardly sound kernels. Aflatoxin was in all the listed fractions, but amounts and distribution of the toxin in each depended on the lot of corn. Aflatoxin was found in the outwardly sound kernel portion because some kernels with fluorescence under the seed coat do not have an abnormal appearance even under ultraviolet light (365 nm.). Fluorescing particles were observed in ground meals of outwardly sound kernels.

- 3541 • Derivatives of High-Amylose Starch Xanthate in Rubber.  
 Influence of Amylose Content of Starch Upon the Water  
 Resistance of Starch-Reinforced Styrene-Butadiene Rubbers  
 H. C. Katz, W. F. Kwolek,<sup>1</sup> R. A. Buchanan, W. M. Doane,  
 and C. R. Russell  
 (<sup>1</sup>Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)  
 Staerke 26(6): 201-206. June 1974

Crosslinked low-amylose (0 or 28%) starch xanthates, used as reinforcing materials in styrene-butadiene elastomer, imparted better dry tensile properties than their high-amylose (55, 68 or 82%) analogues. After low-amylose starch-reinforced vulcanizates had been immersed in water for 70 hours, their tensile strength deteriorated considerably, whereas that of high-amylose starch-reinforced vulcanizates changed little or not at all. Such variables as xanthate degree of substitution and starch loading influenced curing time and properties. Mode of crosslinking the xanthate significantly affected retention of starch in the coprecipitate, and also produced significant variations in curing characteristics, as well as in such properties as compression set, set at break before immersion in water, and tensile strength after water immersion. The method of drying affected compression set and modulus.



## 3542\* • United States Energy from Agriculture

Dwight L. Miller

Proc. Nat. Conf. Agriculture and the Energy Crisis, Lincoln, Nebr., April 10-11, 1973, pp. 37-46. [1974]

Agriculture now provides the major source of renewable energy. Plants are the major converters of solar energy into usable and storable forms of energy. Yet they utilize less than 1% of the available solar energy that hits them. Forests, cultivated crops, and pasture land may be used repeatedly under proper management. Agriculture production is, however, subject to weather, disease, and other natural conditions which cannot yet be completely controlled. Nevertheless, average production in excess of priority requirements for domestic food, feed, and fiber is believed possible for at least this century, barring natural disasters or national emergencies.

## 3543\* • Rigid Urethane Foams from Hydroxymethylated Castor Oil, Safflower Oil, Oleic Safflower Oil, and Polyol Esters of Castor Acids

C. K. Lyon,<sup>1</sup> V. H. Garrett,<sup>1</sup> and E. N. Frankel(<sup>1</sup>Western Regional Research Laboratory, ARS, USDA, Berkeley, Calif.)

J. Amer. Oil Chem. Soc. 51(8): 331-334. August 1974

Castor, safflower, and oleic safflower oil derivatives with enhanced reactivity and hydroxyl group content were prepared by hydroformylation with a rhodium-triphenylphosphine catalyst, followed by hydrogenation. Rigid urethane foams prepared from these hydroxymethylated derivatives had excellent compressive strengths, closed cell contents, and dimensional stability. Best properties were obtained from hydroxymethylated polyol esters of castor acids.

## 3544 • Some Esters of Mono-, Di-, and Tricarboxystearic Acid as Lubricants: Preparation and Evaluation

Edward J. Dufek, W. E. Parker,<sup>1</sup> and R. E. Koos<sup>1</sup>(<sup>1</sup>Eastern Regional Research Laboratory, ARS, USDA, Philadelphia, Pa.)

J. Amer. Oil Chem. Soc. 51(8): 351-355. August 1974

Conditions were determined for selective alkaline transesterification of methyl 9(10)-carbomethoxystearate. With 2,2-dimethylpentanol and 2-ethylhexanol, the corresponding alkyl 9(10)-carbomethoxystearates were obtained in good yield. These two mixed alkyl diesters were evaluated as lubricants, along with other alkyl esters of mono-9(10)-, di-, and tricarboxystearic acids prepared by conventional methods. Several esters compared favorably with dioctyl sebacate used as the control. The esters had high viscosity indices and low ASTM slopes. The pour point of purified dimethylpentyl 9(10)-carbomethoxystearate is below -70° C. Several esters have antiwear properties when added to the control oil.

- 3545 • Reduction of Green Color from Soybean Oil  
 R. E. Beal, K. J. Moulton, and L. T. Black  
 J. Amer. Oil Chem. Soc. 51(8): 380. August 1974

The green color in a refined bleached soybean oil extracted from green soybeans was removed substantially by partially hydrogenating the oil with 1% copper chromite catalyst at 175° C. and 30 p.s.i.g. Hydrogenating the same oil to the identical IV (110) with 0.1% nickel at 150° C. and 15 p.s.i.g. was ineffective.

- 3546 • Divalent Cation Inhibition of 3-Ketodisaccharide Synthesis  
 by *Agrobacterium tumefaciens*  
 L. K. Nakamura and D. D. Tyler  
 Develop. Ind. Microbiol. 15: 377-386. 1974

Zinc and copper ions at 1.0 mM effectively inhibited synthesis of 3-ketodisaccharides (3-KD) by washed cells of *Agrobacterium tumefaciens*.  $\text{Cu}^{2+}$  at 0.1 mM completely inactivated cell-free preparations of the synthetic enzyme, hexopyranoside:cytochrome c oxidoreductase. This ion also inhibited uptake of disaccharides. Since  $\text{Zn}^{2+}$  blocked disaccharide uptake but had no effect on the synthetic enzyme, it apparently inhibited 3-KD synthesis primarily by preventing the sugar from reaching the enzyme.  $\text{Zn}^{2+}$  inhibition of 3-KD synthesis and disaccharide uptake was pronounced at pH 7.5 and weak at pH 6.0. The effect of  $\text{Zn}^{2+}$  was completely reversed by 10.0 mM  $\text{Mg}^{2+}$  at pH 6.0.  $\text{Zn}^{2+}$ -inhibition was reversed by 10.0 mM ethylenediaminetetraacetic acid (EDTA) at pH 6.0 or 7.5. Sensitivity to external pH, as well as reversibility by  $\text{Mg}^{2+}$  and EDTA, suggested that the site of  $\text{Zn}^{2+}$  inhibition of disaccharide transport was on or near the cell surface. Cells preloaded with  $\text{Zn}^{2+}$  also displayed inhibition of 3-KD synthesis, as well as disaccharide uptake.

Inhibition was intensified by prolongation of preloading time or by increased concentrations of  $\text{Zn}^{2+}$ . The inhibition was strong in cells preloaded with  $\text{Zn}^{2+}$  at pH 7.5 but weak in those pretreated similarly at pH 6.0. Inhibition in cells treated with  $\text{Zn}^{2+}$  at pH 6.0 was completely reversed by post-treatment with 10.0 mM  $\text{Mg}^{2+}$ . These data suggested that the effect of  $\text{Zn}^{2+}$  resulted from a rather stable binding of the ion to structures or sites required for sugar uptake. Noncompetitive inhibition of disaccharide uptake by  $\text{Zn}^{2+}$  suggested that the ion interacted with cells at points other than the sugar binding sites required for transport.



- 3547 • Monitoring Coatings Performance Upon Exterior Exposure  
 L. H. Princen, F. L. Baker, and J. A. Stolp  
 Appl. Polym. Symp. No. 23: 27-40. 1974

The behavior of 19 commercial and experimental paints exposed on red cedar has been monitored with a scanning electron microscope. Included were acrylic, vinyl, linseed oil, alkyds, polyurethane, epoxy, chalking and nonchalking formulations, whites and tint-base paints, and glossy and flat finishes. Samples were taken biweekly and studied at 100X, 500X, and 2,000X. Occasionally, the samples were washed gently with soap and water before examination. Visual observations included chalking, dirt collection, whiteness, and gloss. Microwrinkling of the top surface was seen in coatings containing linseed oil and certain alkyds; it disappeared after as little as 2 weeks exposure. Dirt collection was initially strongest on solvent-base paints; latex paints without added alkyds stayed the cleanest. Within 4 to 5 months this behavior reversed: The chalking solvent-base paints appeared whiter and cleaner than the nonchalking latex paints. Chalking appears to be a function not only of pigmentation, but also of vehicle composition. Trim and tint-base paints deteriorated faster than expected. Small ring structures observed in the surface of the 2-component epoxy coating have been described, and a mechanism has been postulated for their formation. Some observations on the mechanism of chalking have been made.

- 3548 • Methionine Regulation of Aflatoxin Biosynthesis  
 by *Aspergillus parasiticus*  
 R. W. Detroy and S. N. Freer  
 Develop. Ind. Microbiol. 15: 124-132. 1974

*Aspergillus parasiticus* shows duality of morphogenesis, known as mold-yeast dimorphism, in which the fungus may develop into either a filamentous form (hyphal-type) or yeastlike form. In a synthetic medium, the pattern of morphogenesis depends upon the level of manganese ions. When yeastlike, the organism is in a nonproliferating state and synthesizes large quantities of aflatoxin, 2-3 mg. aflatoxin/g. dry weight mycelium. A sulfur-amino acid-requiring mutant (25-D) was isolated and characterized for studies on the methylation of aflatoxin compared to the wild-type strain. The biological methylation at the C-8 position of the aflatoxin ring via methionine is sensitive to ethionine antagonism in both the mutant 25-D and NRRL 2999 wild-type strain. Addition of exogenous DL-ethionine (1 mg./ml.) to a culture of *A. parasiticus* 25-D, grown on a synthetic medium supplemented with methionine, inhibited toxin synthesis by 50%; however, when cysteine or homocysteine replaced methionine, ethionine reduced aflatoxin synthesis by as much as 80-100%. Aflatoxin synthesis in the 25-D mutant grown in either a cysteine- or homocysteine-containing medium was inhibited 40-90% by cysteine or methionine analogs. Incorporation of  $^{14}\text{C}$ -formate into the

aflatoxins is inhibited by ethionine and other cysteine-methionine analogs; this restraint indicates a block in methylation with formate as a C<sub>1</sub> donor. Apparently, methionine biosynthesis and C<sub>1</sub> methylation are essential in secondary biosynthesis of the aflatoxins, since prearomatic methylation of the polyketide chain may be a requirement for cyclization and aflatoxin ring formation.

3549 • Treating Corn with Ammonia--Behavior of the Corn-Water-Ammonia System

E. B. Lancaster, G. E. Hall,<sup>1</sup> and O. L. Brekke

(<sup>1</sup>University of Illinois, Urbana)

Trans. ASAE 17(2): 331-334, 338. March-April 1974

Ammonia, a potent fungicide when applied to whole corn, reacts chemically with corn constituents to cause browning. Methods were developed for determining "free" ammonia (by titration of a water-corn mixture) and total ammonia (by neutralization and ammoniacal nitrogen analysis) in treated corn. Fixed ammonia content (total minus free) increased with temperature and time. Free ammonia diffused slowly from the corn kernel into an aqueous phase, requiring 6 hours for 95% completion. In a dry gaseous system, ammonia-free corn embedded in ammonia-treated corn required about 4 days to reach equilibrium.

Gaseous ammonia was absorbed readily by low-moisture corn. When whole corn at 12% moisture was treated with 7% ammonia gas, 3.8% as free ammonia was absorbed when the gas was added slowly during 2 days. In a laboratory experiment, nonuniformity occurred initially in a short column, but the ammonia content became more uniform with time. Calculations indicate that if ammonia is applied as a mixture with air, uniformity and maximum absorption can be controlled. For example, a 10% ammonia-air mixture applied at 80° F. should result in an equilibrium ammonia content of about 1% of the corn.

An unexpected result of ammonia treatment was encountered when 1,500 bushels of high-moisture corn was treated with 0.7% ammonia (dry basis) as aqua ammonia. Self-induced heating occurred; the corn reached a maximum temperature of 165° F. and became extremely dark in color, ammonia became fixed rapidly, and large gradients in moisture and free ammonia occurred. A preliminary experiment has failed to duplicate this phenomenon on a laboratory scale.

3550 • Heavy Metal Removal with Starch Xanthate-Cationic Polymer Complex

Robert E. Wing, Charles L. Swanson, William M. Doane, and Charles R. Russell

J. Water Pollut. Contr. Fed. 46(8): 2043-2047. August 1974



A starch xanthate-poly(vinylbenzyltrimethylammonium chloride) complex effectively removes many heavy metal ions from water. Cadmium(II), chromium(III), copper(II), iron(III), lead(II), nickel(II), and silver(I) ions can be reduced to residual levels below stringent State of Illinois discharge limits. Considerable amounts of iron(II), manganese(II), and zinc(II) are removed, but residual levels for these three exceed the Illinois effluent limits. Mercury(II) is almost completely removed, but still its residual level (3.8  $\mu\text{g./l.}$ ) remains above the accepted Illinois limit (0.5  $\mu\text{g./l.}$ ). The solubility product constant of the metal ion xanthate is related to the completeness of removal. Metals that have  $K_{sp}$ 's with ethyl xanthate below  $10^{-12}$  are almost completely removed. The  $K_{sp}$  method is also effective on mixtures of metals and on industrial effluents containing certain metals.

### 3551 • Partial Synthesis of Harringtonine Analogs

K. L. Mikolajczak, C. R. Smith, Jr., and R. G. Powell  
J. Pharm. Sci. 63(8): 1280-1283. August 1974

Natural antitumor-active esters of cephalotaxine are in short supply and need to be synthesized to meet demands for biological testing. Attempts to prepare these esters by direct esterification of cephalotaxine with an appropriate half-esterified dicarboxylic acid moiety have been thwarted by marked steric hindrance at the reaction site in both reactants. A successful sequence has been devised based on  $\alpha$ -hydroxy- $\alpha$ -methylbutyric acid as a model acid and will be tested for preparation of active cephalotaxine esters.

### 3552 • Formation of Extracellular 3-D-Hydroxypalmitic Acid by

*Saccharomycopsis malanga*

C. P. Kurtzman, R. F. Vesonder, and M. J. Smiley  
Mycologia 66(4): 580-587. July-August 1974

*Saccharomycopsis malanga* comb. nov. is characterized; all strains were isolated from Oriental fermented food starters. One of the strains was previously described as *Hansenula malanga*. All the cultures form free extracellular 3-D-hydroxypalmitic acid, and this compound was inhibitory to *Vibrio tyrogenus* but not to the other microorganisms tested. A key has been prepared to species of the genus *Saccharomycopsis*.

### 3553 • *Rhizopus* and *Chlamydomucor* Strains Surveyed for Milk-Clotting, Amylolytic, and Antibiotic Activities

John J. Ellis, Hwa L. Wang, and Clifford W. Hesseltine  
Mycologia 66(4): 593-599. July-August 1974

Nine strains of *Chlamydomucor oryzae* and 347 strains of *Rhizopus*, representing 10 species, were grown in rice flour and wheat flour media. When grown

on wheat flour medium, nearly all strains exhibited amylolytic activity and more than 300 strains showed milk-clotting activity. Almost all strains of *R. arrhizus* exhibited antibiotic activity against NRRL B-765 *Bacillus subtilis*. The 23 strains of *R. stolonifer* showed none of these activities.

- 3554 • Hydrocarboxylation of Polyunsaturated Fatty Acids and Esters with a Palladium Chloride-Triphenylphosphine Complex Catalyst  
E. N. Frankel, F. L. Thomas, and W. K. Rohwedder  
Advan. Chem. Ser. No. 132: 145-165. 1974

A mixture of palladium chloride and triphenylphosphine effectively catalyzes carboxylation of linoleic and linolenic acids and their methyl esters with water at 110°-140° C. and carbon monoxide at 4,000 p.s.i.g. The main products are 1,3- and 1,4-dicarboxy acids from dienes and tri-carboxy acids from trienes. Other products include unsaturated monocarboxy and dicarboxy acids, carbomethoxy esters, and substituted  $\alpha,\beta$ -unsaturated cyclic ketones. The mechanism postulated for dicarboxylation involves cyclic unsaturated acyl-PdCl-Ph<sub>3</sub>P complexes. These intermediates control double bond isomerization and the position of the second carboxyl group. This mechanism is consistent with our findings of double bond isomerization in polyenes and not in monoenes. A 1,3-hydrogen shift process for double bond isomerization in polyenes is also consistent with the data.

- 3555\* • Spores  
Ann W. Nickerson, Lee A. Bulla, Jr., and Cletus P. Kurtzman  
In "Principles and Techniques of Scanning Electron Microscopy,"  
ed. M. A. Hayat, vol. 1, chap. 7, pp. 159-180. New York. 1974

The scanning electron microscope (SEM) can provide concise, definitive information on spore morphology. General preparative techniques detailed for spores include specimen cleaning, fixation, dehydration, mounting on SEM stubs, and either metal or carbon shadowing. Special attention is given specific techniques used with bacterial, actinomycete, and yeast spores, as well as various types of fungal spores. Representative micrographs of several different kinds of spores are reproduced.



- 3556 • Agronomic and Chemical Evaluation of Selected Sorghums as Sources of Pulp  
 G. A. White,<sup>1</sup> T. F. Clark, J. P. Craigmiles,<sup>2</sup> R. L. Mitchell,<sup>3</sup>  
 R. G. Robinson,<sup>4</sup> E. L. Whiteley,<sup>5</sup> and K. J. Lessman<sup>6</sup>  
 (<sup>1</sup>Plant Genetics and Germplasm Institute, BARC, Beltsville, Md.;  
<sup>2</sup>Texas A&M University, Beaumont; <sup>3</sup>University of Missouri,  
 Columbia; <sup>4</sup>University of Minnesota, St. Paul; <sup>5</sup>Texas A&M University,  
 College Station; <sup>6</sup>Purdue University, Lafayette, Ind.)  
 Econ. Bot. 28(2): 136-144. April-June 1974

Nine sorghum accessions were grown at six locations to evaluate their potential as raw materials for pulp and papermaking. Field yields for several accessions exceeded 10 tons per acre of whole stalks and 6 tons of culms. Broomcorn (PI 177549) was high in cellulose, gave a high yield, and had a low proportion of leaves to culms, but was prone to disease and lodging. This accession, two kafir types, and a sorghumgrass accession merit further research effort.

- 3557 • Chemical Analyses of Seeds III. Oil and Protein Content of 1253 Species  
 A. S. Barclay<sup>1</sup> and F. R. Earle  
 (<sup>1</sup>Crops Research Division, ARS, USDA, Beltsville, Md.)  
 Econ. Bot. 28(2): 179-236. April-June 1974

Scientists of the U.S. Department of Agriculture are actively engaged in basic and applied research aimed at the development of new crops for industrial purposes. The fundamental phases of this research is a cooperative screening program to discover, define, and evaluate new or unusual compounds of promising industrial utility in plants with a reasonable potential for cultivation in the United States. The screening program has revealed--and continues to indicate--species whose development into new domestic crops could satisfy existing needs, or newly developing requirements of our industry as it increases in size and complexity.

- 3558 • Graft Copolymers by Simultaneous <sup>60</sup>Co-Irradiation of Starch, Acrylamide, and *N,N,N*-Trimethylaminoethyl Methacrylate Methyl Sulfate  
 G. F. Fanta, R. C. Burr, W. M. Doane, and C. R. Russell  
 J. Appl. Polym. Sci. 18(7): 2205-2209. July 1974

Simultaneous cobalt-60 irradiations of starch with mixtures of acrylamide and *N,N,N*-trimethylaminoethyl methacrylate methyl sulfate (TMAEMA·MS) were carried out with either unswollen starch granules, in an outwardly dry blend, or with starch that had been swollen in monomer solution. Graft

copolymers were characterized by determining the percent add-on, the intrinsic viscosity of grafted polymer, and the TMAEMA-MS content of grafts. High conversions of monomer to polymer were obtained at low irradiation doses (0.1 Mrad), and a nitrogen purge of the reaction mixture was unnecessary for reactions with swollen starch. Substituting aqueous ethylene glycol as the reaction medium instead of water gave lower molecular weight grafts and a higher conversion to homopolymer.

- 3559 • Dialdehyde Starch, An Alkali Labile Wet-Strength Agent  
B. T. Hofreiter, H. D. Heath, A. J. Ernst, and C. R. Russell  
Tappi 57(8): 81-83. August 1974

A stable solution form of cationic dialdehyde starch (DAS), a wet-strength agent developed in 1959, has been tested on a pilot paper machine. These dispersions, 10-15% concentration, no longer require precise cooking methods with a cationizing agent at the mill.

Wet-strength permanency of unbleached kraft papers treated with cationic DAS was compared with that produced by other commercial wet-strength agents. Although cationic-DAS paper loses about 55% of its initial wet strength after 48 hours of water immersion, the original wet strength is substantially regained upon drying at ambient conditions. When the pulping medium is made mildly alkaline (pH 11), DAS-treated paper repulps as well as non-wet-strength kraft paper. Excellent dry-strength properties--e.g., total energy absorbed until specimen failure--were imparted by cationic DAS.

- 3560 • *Saussurea candicans* Seed Oil--Alternative Source of Crepenynic Acid  
C. R. Smith, Jr.  
Lipids 9(8): 640-641. August 1974

Crepenynic acid represents 33% of the constituent fatty acids of *Saussurea candicans* seed oil. This important acetylenic acid, after isolation by countercurrent distribution, was characterized unambiguously by derivatives and by degradative procedures.

- 3561 • Screening Seed of *Trigonella* and Three Related Genera for Diosgenin  
M. B. Bohannon, J. W. Hagemann, F. R. Earle, and A. S. Barclay<sup>1</sup>  
(<sup>1</sup>Plant Genetics and Germplasm Institute, ARS, USDA, Beltsville, Md.)  
Phytochemistry 13(8): 1513-1514. August 1974

Seed of 45 species of Leguminosae were analyzed for diosgenin by gas chromatography. Since the method did not separate yamogenin and tigogenin from diosgenin, results indicate maximum limits rather than the actual amounts of diosgenin present. Among 27 species of *Trigonella* tested, only six could have as much as 0.2% diosgenin. The highest possibility was 0.8% in one sample of *T. foenum-graecum*. Among seven species of *Medicago*, six species of *Melilotus* and five species of *Trifolium*, none contained more than 0.1% diosgenin.

### 3562\* • Microbial Transformation of Terpenes

Alex Ciegler

In "Handbook of Microbiology. Vol. IV. Microbial Metabolism, Genetics and Immunology," eds. Allen I. Laskin and Hubert A. Lechevalier, pp. 449-458. Cleveland, Ohio. 1974

All the known published microbiological transformations of terpenes have been brought together into one table.

### 3563 • Stress Relaxation of Starch Xanthide Reinforced Vulcanizates

E. B. Bagley and R. E. Dixon

Trans. Soc. Rheology 18(3): 371-394. July-September 1974

Simple extension tests on starch xanthide and carbon black reinforced rubbers were undertaken to obtain information on reinforcement mechanisms in the two types of systems. Systematic time effects were discovered that resolved earlier problems of data inconsistency. The major differences between xanthide and carbon black filled rubbers were observed at small deformations, where the xanthide systems are extremely stiff. This condition undoubtedly relates to the serious problem of large permanent set in xanthide-reinforced elastomers.

### 3564 • Micro-Kjeldahl Analysis by an Improved Automated Ammonia Determination Following Manual Digestion

J. A. Bietz

Anal. Chem. 46(11): 1617-1618. September 1974

An automated procedure published in 1971 by Crooke and Simpson (J. Sci. Food Agr. 22: 9) to determine ammonium in manual macro-Kjeldahl digests was modified to permit N analysis of micro-Kjeldahl digests. After digestion and dilution of samples, ammonium is determined colorimetrically on a Technicon AutoAnalyzer by the salicylate-dichloroisocyanurate reaction in the presence of nitroprusside. Accuracy of this method is comparable to manual distillation and titration: from 40 to 60 samples can be analyzed per hour. Samples containing as little as 5 µg. N (one-tenth to one-hundredth of the amount normally used for manual ammonium determinations) can be analyzed.



3565 • Potential Controlled-Release Herbicides from 2,4-D Esters of Starches

C. L. Mehltretter, W. B. Roth, F. B. Weakley, T. A. McGuire, and C. R. Russell

Weed Sci. 22(5): 415-418. September 1974

Unmodified, cyanoethylated, and crosslinked corn starches were reacted with 2,4-dichlorophenoxyacetyl chloride in pyridine to afford the corresponding esters of high acyl content. Hydrolysis studies at pH 6 and 8 at ambient temperature showed that all of the esters liberated 2,4-D and soluble bound 2,4-D at rates that indicate promise for their utilization as controlled-release herbicides.

3566 • Natural Occurrence of Mycotoxins in Cereals

C. W. Hesseltine

Mycopathol. Mycol. Appl. 53(1-4): 141-153. August 1974

Besides peanuts and cottonseed, cereal grains are the most important feed and food source that occasionally are naturally contaminated with mycotoxins. The problem of mycotoxins occurring naturally in cereals, especially in corn, has become troublesome because of changing agricultural technology. The mycotoxin problem in cereals is not restricted to any geographic or climatic region. Toxins are produced on cereals, both in the field and in storage; they involve both the grain and the whole plant. The genera of the fungi most involved are *Aspergillus*, *Fusarium*, *Penicillium*, and *Claviceps*. Mycotoxins known to occur naturally in cereals include aflatoxins B<sub>1</sub>, B<sub>2</sub>, G<sub>1</sub>, and G<sub>2</sub>--as well as aflatoxins M<sub>1</sub> and M<sub>2</sub>--ochratoxins A and B, penicillic acid, patulin, ergot, zearalenone, citrinin, T-2, tenuazonic acid, kojic acid, and sterigmatocystin. Of these mycotoxins, aflatoxins, patulin, penicillic acid, and sterigmatocystin are carcinogens.

3567 • Catalytic Carboxylation of Fats: Carboxy Acids from Polyunsaturates

E. N. Frankel, F. L. Thomas, and W. F. Kwolek<sup>1</sup>

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J. Amer. Oil Chem. Soc. 51(9): 393-396. September 1974

Studies with a palladium chloride-triphenylphosphine catalyst have been extended to the carboxylation of polyunsaturated fats. Linseed, soybean, and safflower oils, acids, and esters were carboxylated catalytically with water-carbon monoxide (4000 p.s.i.g.) at 120° to 160° C. with or without acetone as a solvent. Main products were monocarboxy, 1,3- and 1,4-dicarboxy and tricarboxy acids. Minor products were carbomethoxy esters and disubstituted 2-cyclopentenone. Optimum reaction conditions were determined for the carboxylation of linseed oil and methyl esters by statistically designed experiments. Yields of total carboxy and tricarboxy

acids were maximized at low triphenylphosphine and water levels, low temperatures, and high palladium-chloride concentrations.

Carboxylated soybean esters were separated by ether extraction of the palladium catalyst from sodium carbonate or hydroxide carboxylate salts. This salt extraction permits catalyst recycling.

- 3568 • Analysis and Monitoring of *Trans*-Isomerization by IR Attenuated Total Reflectance Spectrophotometry  
H. J. Dutton  
J. Amer. Oil Chem. Soc. 51(9): 407-409. September 1974

Attenuated total reflectance for infrared determination of *trans*-isomers in fats appears to have distinct advantages over procedures currently used. The AOCS standard method CD 14-61 requires weighing and quantitative dilution of a sample with carbon disulfide before spectrophotometric analysis at 10.3  $\mu\text{m}$ . In contrast, according to the attenuated total reflectance analytical procedure, one neither weighs nor dilutes but merely fills the cell with oil and reads at 10.3  $\mu\text{m}$ . In addition to analyses for *trans*-isomers in liquid oils, margarines, and shortenings, attenuated total reflectance enables one to monitor *trans* development continuously during hydrogenation. The presence of catalyst in unfiltered hydrogenated oils does not interfere with attenuated total reflectance measurements in contrast to classical transmission measurements. Unfiltered oil from the hydrogenator can be circulated through the attenuated total reflectance cell to record *trans*-isomerization during the reaction.

- 3569 • Homolytic Decomposition of Linoleic Acid Hydroperoxide: Identification of Fatty Acid Products  
H. W. Gardner, R. Kleiman, and D. Weisleder  
Lipids 9(9): 696-706. September 1974

An isomeric mixture of linoleic acid hydroperoxides, 13-hydroperoxy-*cis*-9,*trans*-11-octadecadienoic acid (79%) and 9-hydroperoxy-*cis*-12,*trans*-10-octadecadienoic acid (21%), was decomposed homolytically by Fe(II) in an ethanol-water solution. In one series of experiments, the hydroperoxides were decomposed by catalytic concentrations of Fe(II). The  $10^{-5}$  M Fe(III) used to initiate the decomposition was kept reduced as Fe(II) by a high concentration of cysteine added to the reaction in molar excess of the hydroperoxides. Nine different monomeric (no detectable dimeric) fatty acids were identified from the reaction. Analyses of these fatty acids revealed that they were mixtures of positional isomers identified as follows: (I) 13-oxo-*trans,trans*- (and *cis,trans*-) 9,11-octadecadienoic and 9-oxo-*trans,trans*- (and *cis,trans*-) 10,12-octadecadienoic acids; (II) 13-oxo-*trans*-9,10-epoxy-*trans*-11-octadecenoic and 9-oxo-*trans*-12,13-epoxy-

*trans*-10-octadecenoic acids; (III) 13-oxo-*cis*-9,10-epoxy-*trans*-11-octadecenoic and 9-oxo-*cis*-12,13-epoxy-*trans*-10-octadecenoic acids; (IV) 13-hydroxy-9,11-octadecadienoic and 9-hydroxy-10,12-octadecadienoic acids; (V) 11-hydroxy-*trans*-12,13-epoxy-*cis*-9-octadecenoic and 11-hydroxy-*trans*-9,10-epoxy-*cis*-12-octadecenoic acids; (VI) 11-hydroxy-*trans*-12,13-epoxy-*trans*-9-octadecenoic and 11-hydroxy-*trans*-9,10-epoxy-*trans*-12-octadecenoic acids; (VII) 13-oxo-9-hydroxy-*trans*-10-octadecenoic and 9-oxo-13-hydroxy-*trans*-11-octadecenoic acids; (VIII) isomeric mixtures of 9,12,13-dihydroxyethoxy-*trans*-10-octadecenoic and 9,10,13-dihydroxyethoxy-*trans*-11-octadecenoic acids; and (IX) 9,12,13-trihydroxy-*trans*-10-octadecenoic and 9,10,13-trihydroxy-*trans*-11-octadecenoic acids. In another experiment, equimolar amounts of Fe(II) and hydroperoxide were reacted in the absence of cysteine. A large proportion of dimeric fatty acids and a smaller amount of monomeric fatty acids resulted. The monomeric fatty acids were examined by gas liquid chromatography-mass spectroscopy. Spectra indicated that the monomers were largely similar to those produced by the Fe(III)-cysteine reaction.

### 3570 • Immobilized $\alpha$ -Amylase for Clarification of Colloidal Starch-Clay Suspensions

K. L. Smiley, J. A. Boundy, B. T. Hofreiter, and S. P. Rogovin  
*In* "Immobilized Enzymes in Food and Microbial Processes,"  
 eds. A. C. Olson and C. L. Conney, pp. 133-147. New York. 1974

White water from paper mills is typical of a colloidal starch waste stream containing suspended solids. Laboratory-scale experiments demonstrated that immobilized  $\alpha$ -amylase can degrade starch in paper mill-type effluents. When bound to either nylon, protein-adsorbent resin, or polyacrylamide-cotton cloth supports,  $\alpha$ -amylase was stable for prolonged periods of continuous use. Settling rates of white-water solids were improved by treatment with immobilized amylase followed by addition of alum.

### 3571 • Removal of Heavy Metals from Waste Waters with a Starch Xanthate-Cationic Polymer Complex

R. E. Wing  
 Proc. 8th Nat. Conf. Wheat Util. Res., held at Denver, Colo.,  
 October 10-12, 1973, U.S. Agr. Res. Serv., ARS-W-19, pp. 26-31.  
 September 1974

Worldwide concern developed a few years ago when people became aware of the effect of discharging industrial effluents containing heavy metals into waterways. This led to the formation of a set of strict discharge limits for heavy metals that must be met before industrial effluents can be discharged. Several methods have been developed and are being used to treat these industrial effluents contaminated with heavy metals: (1) chemical



precipitation with lime, alum, or iron salts; (2) chemical treatment by oxidation or reduction; (3) ion exchange; (4) ultrafiltration; (5) electrochemical; and (6) evaporative recovery. Each of these methods have advantages but most have disadvantages requiring special modifications before use by certain industries. The method developed at the Northern Regional Research Laboratory in Peoria offers industry a tool to remove heavy metals in most cases to concentrations below discharge limits.

### 3572 • Composition and Functional Properties of Milled Fractions of Triticale

R. A. Anderson, A. C. Stringfellow, and J. S. Wall  
Proc. 8th Nat. Conf. Wheat Util. Res., held at Denver, Colo.,  
October 10-12, 1973, U.S. Agr. Res. Serv., ARS W-19, pp. 74-80.  
September 1974

Triticale grain can be dry milled to provide flour and flour fractions. Starch and gluten can be recovered from triticale grain or flour by conventional wet processing. Triticale is a good potential source of protein-rich supplements for food products, as well as a source of flour and starch fractions for food, feed, and industrial applications.

### 3573 • Wet Milling of Wheat and Oats by Alkaline Extraction

Y. V. Wu, K. R. Sexson, and J. E. Cluskey  
Proc. 8th Nat. Conf. Wheat Util. Res., held at Denver, Colo.,  
October 10-12, 1973, U.S. Agr. Res. Serv., ARS W-19, pp. 93-96.  
September 1974

Alkaline wet-milling processes were developed for whole wheat and for oat groats. The alkaline process for whole wheat gives a protein concentrate that is superior in protein content and yield to the earlier acidic process. Alkaline extraction of whole wheat and of oat groats produces a protein concentrate, a screened residue, and starch. These products from wet milling should find outlets in foods.

### 3574 • Agriculture and Industrial Energy

Dwight L. Miller  
Proc. 8th Nat. Conf. Wheat Util. Res., held at Denver, Colo.,  
October 10-12, 1973, U.S. Agr. Res. Serv., ARS W-19, pp. 106-109.  
September 1974

Agricultural products are a major renewable source of energy. Agriculture has normally been included in the energy-producing sector of the U.S. economy. Overall, the production, processing, and distribution of

agricultural crops consume more energy than they provide. Power from machines, with major inputs from fossil fuels, has greatly increased production. Agriculture based primarily on human-animal power cannot provide food and fiber required by U.S. citizens. Maximum utilization of total materials, including byproducts and residues, is a future necessity to reduce the energy imbalance.

- 3575 • Publications and Patents of the Northern Regional Research Laboratory, January-June 1974  
North. Res. Res. Lab., ARS, USDA, 60 pp. [October 1974]

- 3576 • Wheat in Perspective  
G. E. Inglett  
*In "Wheat: Production and Utilization,"* ed. George E. Inglett, chap. 1, pp. 1-7. Westport, Conn. 1974

Wheat provides more nourishment for people throughout the world than any other food source. Bread, the principal food made from wheat, has been basic to human diets since the beginning of recorded history of civilized man. In modern times, bread has been enriched with certain vitamins and minerals. Enrichment of U.S. bread with thiamine and niacin is credited with almost completely eliminating beri-beri and pellagra. The most impressive changes in wheat during the 20th century include: (1) increased production, particularly by semidwarf varieties; (2) growth of international trade; (3) decline in consumption in industrialized countries; but (4) rising consumption in many other areas of the world.

- 3577\* • Production  
Clarence A. Moore<sup>1</sup>  
(<sup>1</sup>Economic Research Service, USDA, Peoria, Ill.)  
*In "Wheat: Production and Utilization,"* ed. George E. Inglett, chap. 3, pp. 31-51. Westport, Conn. 1974

Wheat is a major commodity in U.S. agriculture. Annual variations in acreage, production, and value are large; but roughly 50 million acres are used to produce about 1.5 billion bushels of the grain valued at \$2 billion. Wheat ranks with corn, soybeans, and hay as the leading U.S. field crops. This chapter discusses the general conditions under which wheat is grown. A brief view of world production at the beginning serves as background. Domestic production is discussed in terms of characteristics of wheat farming, crop trends, crop hazards, the farmer's economic decisions, and long-term improvements in wheat production. A final section considers price relationships and recent wheat policy.

## 3578\* • Marketing

Clarence A. Moore<sup>1</sup>(<sup>1</sup>Economic Research Service, USDA, Peoria, Ill.)*In "Wheat: Production and Utilization,"* ed. George E. Inglett, chap. 5, pp. 72-92. Westport, Conn. 1974

Wheat passes through many hands, a number of handling firms, and various treatments and processes on its way from the farm to the table, feedlot, or industrial firm where it is used. Food grains generally require more care in marketing and more processing than feed grains. The domestic market demand is substantial for all types and qualities of wheat, and most kinds are grown in the U.S. Production and use of the different wheats broadens the domestic wheat economy and enhances bargaining strength of U.S. wheats abroad. However, it complicates grading and marketing. The different kinds of wheat are grown under such varied geographic, moisture, and cultural conditions that even the same wheats vary considerably in quality. Thus, it is difficult to segregate the grain by kind and quality and maintain it through the market. When buyers and sellers in the market lack specific knowledge of the kind and quality of wheat they are buying, the market fails to reflect the price information that depicts end-use consumer preference back through the market to the grower.

## 3579 • Kernel Structure and Composition

George E. Inglett

*In "Wheat: Production and Utilization,"* ed. George E. Inglett, chap. 7, pp. 108-118. Westport, Conn. 1974

A wheat kernel is often referred to as the one-seeded fruit or, botanically, caryopsis of the common wheat plant *Triticum aestivum*. Kernel composition varies more widely in wheat than in any other cereal grain. Although the usual range for protein is from 8 to 15%, values as low as 7% and as high as 24% occur. Such genetic differences and cultural conditions as temperature, rainfall, cultivation, and soil characteristics are mainly responsible for compositional variation. Microscopic studies of grain structure are reviewed, as well as kernel composition.

## 3580 • Flour Milling

George E. Inglett and Roy A. Anderson

*In "Wheat: Production and Utilization,"* ed. George E. Inglett, chap. 10, pp. 186-198. Westport, Conn. 1974

The milling of wheat is a manufacturing process that provides a maximum profit from the most favorable distribution of salable products. Milling is controlled to produce as much quality flour, farina, and germ as practical from good clean wheat. A standard hard wheat gives the following milled products: farina, patent flour, first clear flour, second clear flour, germ, shorts, and bran. The amount of each product depends upon the raw material, cleaning, conditioning, and milling operation.



## 3581\* • Wet-Processing of Wheat Flour

Roy A. Anderson

*In "Wheat: Production and Utilization,"* ed. George E. Inglett,  
chap. 13, pp. 355-365. Westport, Conn. 1974

The production of starch and gluten from wheat flour is described in detail, together with the food uses of these products.

## 3582\* • Industrial Uses of Wheat and Flour

Dwight L. Miller

*In "Wheat: Production and Utilization,"* ed. George E. Inglett,  
chap. 16, pp. 398-411. Westport, Conn. 1974

Compositionally, wheat is similar to other common cereal grains and, with minor treatment or handling, is industrially interchangeable. For centuries wheat has been primarily a food grain realizing high market value. Consequently, industrial markets have been small, except during World War II, when price was not the controlling factor. From a physical and chemical standpoint, wheat is a suitable raw material for many industrial uses, and processing techniques are available to produce alcohol, starch, and paper additives from it. Although the unique properties of wheat gluten offer a way to increase industrial markets for wheat and flour, extensive fundamental and applied research is still needed. Genetic modification to produce lower cost wheat varieties specifically for industrial uses also remains to be exploited.

## 3583\* • Distribution and Utilization of U.S. Wheat

Kenneth R. Majors<sup>1</sup>

(<sup>1</sup>Grain Products Extension Service, USDA, Peoria, Ill.)

*In "Wheat: Production and Utilization,"* ed. George E. Inglett,  
chap. 17, pp. 412-463. Westport, Conn. 1974

For major wheat-consuming countries that produce less than enough of the grain to meet their basic requirements or to lay up reserves for lean years, the yearly distribution of world wheat surpluses fulfills a critical need. This becomes even more critical whenever crop yields in those countries fall much below average. Adequate distribution of the world's excess wheat production to the wheat-deficit countries is a boon also to countries such as the U.S., where production substantially above that needed for a comfortable reserve is the norm. Characterization of the yearly distribution and utilization of U.S. wheat involves a rather intricate tabulation. Total disappearance of the grain is accounted for in two broad arbitrary categories, namely, all wheat leaving continental U.S. and all wheat used inside the U.S. Exports of flour and other wheat products are included in terms of wheat equivalents.

- 3584 • Physical-Chemical Characteristics and Heavy Metal Content of Corn Grown on Sludge-Treated Strip-Mine Soil  
William J. Garcia, Charles W. Blessin, George E. Inglett, and Robert O. Carlson<sup>1</sup>  
(<sup>1</sup>Metropolitan Sanitary District of Greater Chicago, Chicago, Ill.)  
J. Agr. Food Chem. 22(5): 810-815. September-October 1974

Corn was grown on strip-mine soil where anaerobically digested liquid sludge had been applied at a rate of 25 tons of sludge solids per acre. An adjacent plot of soil received no sludge. Corn grain grown on untreated strip-mine soil was characterized as immature and kernel size varied from small to intermediate, with about 20% of the kernels being diseased. In contrast, sludge-grown corn was well developed and corn yield increased fourfold over the untreated corn. Furthermore, a significant protein enhancement of 2.5 percentage points was also realized. Concentrations of seven heavy metals (Zn, Mn, Cu, Pb, Cr, Cd, Hg) increased in grain, cobs, and husks in that order. For corn grain grown on untreated and sludge-treated soils, essentially no significant differences were found in heavy metal content when compared to 11 other corn varieties grown normally. Heavy metal contents of both soil and sludge samples were also determined.

- 3585 • Growth of Indigenous Organisms in Aerated Filtrate of Feedlot Waste  
B. A. Weiner and R. A. Rhodes  
Appl. Microbiol. 28(3): 448-451. September 1974

Filtrates from feedlot waste were incubated under aerobic conditions to evaluate the availability of nutrients for cell production and to assess the capacity of indigenous flora to produce stabilized effluents. Incubation was carried out in 9-liter aerated jar fermentors. Three-fourths of the organic material and one-third of the nitrogen were taken up in 4 days; 90% utilization of organic material and nitrogen required almost a month. Acid was produced initially, but aerated liquid thereafter rapidly became alkaline. With pH controlled at 7.0, a comparable pattern of carbon utilization occurred, but nitrogen was incompletely used. The numerically dominant organisms in the waste inoculum were almost immediately displaced by an emergent population of a few types of organisms not originally evident. Maximal viable populations of  $10^9$  to  $3 \times 10^9$  cells/ml. were obtained in aerated waste liquid within 48 hours; subsequently, numbers declined quickly to initial levels. Numbers of fungi, yeasts, and streptomycetes slowly increased but never exceeded their initial concentration by more than tenfold.

- 3586 • Lethality in Mice of Double-Stranded Ribonucleic Acid from Virus-Like Particles of *Penicillium stoloniferum*  
G. A. Sansing, E. B. Lillehoj, S. N. Freer, and R. W. Detroy  
Toxicol 12: 513-521. 1974

The LD<sub>50</sub> in mice of intact virus-like particles (VLP) from *Penicillium stoloniferum* NRRL 5267 was greater than 240 mg./kg. body weight, and their component double-stranded ribonucleic acid (dsRNA) was 34.0 mg./kg. Judged by decreases in LD<sub>50</sub> values, administration of sublethal amounts of actinomycin D or cycloheximide simultaneously with sublethal amounts of intact VLP or mycoviral dsRNA enhanced lethality in mice. A 2400-fold increase in the lethality of intact VLP occurred in mice treated with actinomycin D and a 65-fold increase with cycloheximide and VLP. Increases in lethality of 850-fold with actinomycin D and 10-fold with cycloheximide were determined when mice were treated simultaneously with either antibiotic and mycoviral dsRNA. Similar lethality effects were observed in mice simultaneously treated with polyribonucleosinic-polyribocytidylic acid and either of the antibiotics. Animals treated at zero-time with mycoviral dsRNA and subsequently treated at 1, 2, 4, 8, and 12 hours with actinomycin D generally exhibited a reduced toxic response after the 4-hour injection with actinomycin D. Animals treated at zero-time with actinomycin D and subsequently with mycoviral dsRNA also exhibited a reduced toxic response after the 4-hour injection with the nucleic acid.

- 3587 • Sugar Orthocarbonates  
Edward I. Stout, Baruch S. Shasha, Donald Trimmell,  
William M. Doane, and Charles R. Russell  
Carbohydr. Res. 36(2): 311-318. September 1974

A simple procedure for preparing sugar orthocarbonates is based on treatment of the corresponding thionocarbonate in pyridine with cupric acetate and with an alcohol such as methanol, ethanol, or isopropanol.

- 3588 • Structure-Taste Relationships in (1→2)-Linked Disaccharides  
William E. Dick, Jr., John E. Hodge, and George E. Inglett  
Carbohydr. Res. 36(2): 319-329. September 1974

Nine (1→2)-linked glycosyl-D-glucoses were synthesized by condensing the appropriate O-acetylated glycopyranosyl bromides with 1,3,4,6-tetra-O-acetyl- $\alpha$ -D-glucose. The D-xylo-, D-gluco-, and D-galactosyl bromides formed approximately equal amounts of the  $\alpha$ - and  $\beta$ -linked disaccharides, whereas the L-arabino-, L-rhamno-, and D-mannosyl analogs formed one major product having O-1' and O-2', respectively, *cis*, *trans*, and *trans*. Five of the nine crystalline disaccharide peracetates are new. All were deacetylated and compared, in 3% aqueous solutions, with 0.5, 1.0, and 1.5% aqueous solutions



of sucrose for sweetness and with 0.05% aqueous caffeine for bitterness. Although none scored a sweetness value as high as that of 1% sucrose, each of the four sweetest members of the series had a C1 (D) or (L) conformation and each had an axial O-1' atom *cis* to O-2'. The less sweet members of the series had O-1' and O-2' in a *trans* relationship, either diaxial or diequatorial, and were substantially more bitter than the sweeter group of disaccharides.

- 3589 • High-Resolution Liquid Chromatography of Vitamin E Isomers  
J. F. Cavins and G. E. Inglett  
Cereal Chem. 51(5): 605-609. September-October 1974

High-resolution liquid adsorption chromatography on a 2-meter Corasil II column was found to provide optimum separation of the eight naturally occurring vitamin E isomers. Columns were eluted by a single solvent mixture at a flow rate of 1 ml. per minute and separation was achieved in approximately 1.75 hours. The flow rate or the solvent polarity may be increased to speed elution when complete separation is not necessary. The procedure has been used for preparative purposes.

- 3590\* • Fatty-Acid Esters of Alkoxylated Polyol Glycosides as Emulsifiers in White Layer Cake  
L. T. Kissell,<sup>1</sup> D. K. Mecham,<sup>2</sup> and C. L. Mehlretter  
(<sup>1</sup>Soft Wheat Quality Laboratory, Ohio Agricultural Research Center, ARS, USDA, Wooster; <sup>2</sup>Western Regional Research Laboratory, ARS, USDA, Berkeley, Calif.)  
Cereal Chem. 51(5): 616-623. September-October 1974

Functional emulsification properties were determined for a series of products prepared by direct reaction of glycerol or propylene glycol with starch or lactose in acid media, followed by alkoxylation with ethylene oxide and propylene oxide, and esterification to introduce one or two fatty acid residues. All materials were tested in white layer cake batters prepared according to AACC Methods. Most effective, and comparing favorably with commercial mono- and diglyceride emulsifiers, were mono- and dipalmitates of moderately ethoxylated propylene glycol and glycerol glycosides. Next in effectual order were the distearate and mono- and dioleate esters. Many of the emulsifiers were too powerful for the high sugar:shortening ratio cake formulation. All surfactants were re-evaluated at reduced levels of total added fat. With the emulsifiers held constant at 2% of the fat, improvement was noted in volume, contour, and grain of cakes by reduction of shortening from 50% (flour basis) to the 35 to 25% range. Preliminary studies to determine the safety of these materials as food additives are underway.

- 3591 • Chromanone Acids in *Calophyllum brasiliense* Seed Oil  
R. D. Plattner, G. F. Spencer, D. Weisleder, and R. Kleiman  
Phytochemistry 13(11): 2597-2602. November 1974

A mixture of *cis* and *trans* forms of three homologous free acids (chromanones) make up about 20% of a pentane-hexane extract from *Calophyllum brasiliense* seed kernels. Only trace amounts are present of *cis* isomers. Four of these six chromanone acids were isolated as methyl esters by countercurrent distribution. Structures of the six components were determined by a variety of chemical and spectroscopic methods, including  $^1\text{H}$ -NMR,  $^{13}\text{C}$ -NMR, and gas chromatography-mass spectrometry. Two proved to be the previously reported isoapetalic and blancoic acids.

- 3592 • Interpolymer from Starch Xanthate and Polyamide-Polyamine-Epichlorohydrin Resin in Linerboard and Newsprint  
M. E. Carr, B. T. Hofreiter, G. E. Hamerstrand, and C. R. Russell  
Tappi 57(10): 127-129. October 1974

An interpolymer, formed from a commercial polyamide-polyamine-epichlorohydrin resin (I) and starch xanthate (II) of 0.12 degree of substitution, was evaluated as a wet-end additive on a pilot paper machine. *In situ* formation of the interpolymer in linerboard and recycled newsprint furnishes resulted in excellent wet- and dry-strength benefits and high additive retention. Addition levels of I (0.125-1.0%), II (0.25-2.0%), and furnish pH (5-9) were correlated with wet- and dry-strength properties of paper, retention of II, and furnish drainage rate. Some cost-performance data are given.

- 3593 • 9(10)-Carboxyoctadecylamine and 9(10)-Aminomethyloctadecanoic Acid: Synthesis and Polymerization to Polyamides with Lateral Substitution  
W. R. Miller, W. E. Neff, E. N. Frankel, and E. H. Pryde  
J. Amer. Oil Chem. Soc. 51(10): 427-432. October 1974

9(10)-Carboxyoctadecylamine (I) and 9(10)-aminomethyloctadecanoic acid (II) have been prepared from selectively hydroformylated oleonitrile and oleic acid, respectively. Polymerization of I gave a transparent hard, somewhat brittle polyamide, whereas polymerization of II gave a soft, rubbery polymer that flowed slowly at room temperature. Copolymers of I with II had properties reflecting those of the component homopolymers, although II exercised a disproportionate softening effect. The same was generally true of copolymers of I or II with nylon-66 salt, caprolactam, and 9-aminononanoic acid. The copolymer of I with 25 mole percent nylon-66 salt was transparent, was also elastic, and could be either drawn into fibers or made into a coherent film. The properties of the two amino acids and of their polymers agreed with those expected from simpler alkyl-substituted amino acids.

3594 • Iron and Phosphorus Contents of Soybean Oil from Normal and Damaged Beans

C. D. Evans, G. R. List, R. E. Beal, and L. T. Black  
J. Amer. Oil Chem. Soc. 51(10): 444-448. October 1974

Analyses of commercial crude soybean oils showed a highly significant correlation of 0.74 between free fatty acid and iron content. Poor flavor characteristics exhibited by finished oils extracted from damaged beans may be caused in part by a higher free fatty acid and related higher iron content in crude oils. Source of the increased iron appears to be both damaged beans and steel processing equipment. Crude oil from damaged beans is 2-10 times higher in iron than crude oil extracted from sound beans. Iron appears loosely bound in soybeans, since autoclaving, spontaneous heating in storage, or treating with alcohol increased the level of iron in laboratory-extracted crude oil from 0.2 to more than 1 p.p.m. Present data do not indicate that iron and phosphorus contents are associated statistically in extracted oils.

3595 • 5,5-Dimethyloxazolidine-2-thione Formation from Glucosinolate in *Limnanthes alba* Benth. Seed

M. E. Daxenbichler and C. H. VanEtten  
J. Amer. Oil Chem. Soc. 51(10): 449-450. October 1974

A crystalline compound, identified as 5,5-dimethyloxazolidine-2-thione was isolated from defatted *Limnanthes alba* var. *alba* (meadowfoam) seed meal by either of two procedures: The precursor glucosinolate was separated and then hydrolyzed with an added thioglucosidase (EC 3.2.3.1) prepared from mustard seed. Alternatively, endogenous thioglucosidase was allowed to act in an aqueous slurry of the *L. alba* meal, and subsequently 5,5-dimethyloxazolidine-2-thione was purified from the autolysis products. Previous workers reported 5,5-dimethyloxazolidine-2-thione formation in seed meals of only two Cruciferae genera. Among seed samples we analyzed representing the *Limnathaceae* species, production of the rare oxazolidinethione derivative was unique to *L. alba*.

3596 • Secondary Products from High Pressure Hydrogenation of Crambe Oil

G. F. Spencer, H. J. Nieschlag, and J. A. Rothfus  
J. Amer. Oil Chem. Soc. 51(10): 451-455. October 1974

Hydrogenation of crambe oil, mainly an  $\alpha, \alpha'$ -dierucoyl triglyceride, in the presence of cadmium-promoted copper-chromite provides long chain waxes being sought as sperm whale oil replacements. Gas liquid chromatography and gas chromatography-mass spectrometry analyses of secondary products indicate, however, that reduction proceeds rather differently from Adkins-type



hydrogenations of triglycerides over copper-chromium oxide catalysts. Mono- and diunsaturated alkenes ranging from C<sub>16</sub> to C<sub>24</sub>, odd chain lengths included, constitute approximately 1% of the product. Esters of crambe acids with methyl, ethyl, *n*-propyl, and isopropyl alcohols account for less than 5%. These alcohols and traces of 1,2-propanediol from the hydrogenolysis of glycerol occur in either the head gas or the reaction mixture, or both. In contrast to published results for Adkins-type hydrogenations of triglycerides, *n*-propyl alcohol is far more abundant than isopropyl alcohol or 1,2-propanediol. Isopropyl esters of C-18 acids are not present, and those of C-22 acids constitute no more than 2% of the total esters. Low proportion of isopropyl esters and enrichment of C-22 acids in the secondary products compared with C-18 acids suggest that the acyl substituent at the  $\beta$ -position of glycerol is eliminated during hydrogenation of crambe oil with a Cd-Cu-Cr catalyst.

3597 • Specimen Holder to Critical-Point Dry Microorganisms for Scanning Electron Microscopy

C. P. Kurtzman, F. L. Baker, and M. J. Smiley  
Appl. Microbiol. 28(4): 708-712. October 1974

Critical-point drying of microorganisms for scanning electron microscopy can be done rapidly and effectively by use of a newly designed specimen holder. Up to eight different samples of spores or vegetative cells are placed between polycarbonate membrane filters in this holder and processed through solvent dehydration and critical-point drying using carbon dioxide without loss or cross contamination of microorganisms. Yeasts, molds, bacteria, and actinomycetes have been successfully processed.

3598 • *Penicillium stoloniferum* Virus: Large-Scale Concentration and Purification by Polyethylene Glycol

R. W. Detroy and P. E. Still  
Appl. Microbiol. 28(4): 733-735. October 1974

An experimental procedure developed to concentrate fungal viruses from large volumes of homogenized mycelia with water-soluble polymers, such as polyethylene glycol, possesses advantages over more conventional methods. Concentration of the *Penicillium stoloniferum* fast-moving virus from mycelial homogenates after addition of polyethylene glycol was rapid and produced large quantities of pure virus.

3599 • Dispersions or Solutions? A Mechanism for Certain Thickening Agents

N. W. Taylor and E. B. Bagley

J. Appl. Polym. Sci. 18(9): 2747-2761. September 1974

Hydrolyzed starch-polyacrylonitrile (H-SPAN) graft copolymers form highly viscoelastic mixtures with water, even at concentrations less than 1% by weight. In many ways these mixtures behave like ordinary polyelectrolyte solutions, but dilution experiments revealed that linear reduced viscosity-concentration plots could not be obtained even under ostensibly isoionic dilution conditions. This result, combined with a determination of gel content from centrifugation studies, led to the conclusion that high viscosity H-SPAN water mixtures consist of swollen, deformable gel particles closely packed in intimate contact. Under high dilution or at high ionic strength conditions, the gel particles no longer are tightly packed, solvent is present in excess, the viscosity drops precipitously, and the thickening action effectively disappears. For comparative purposes, a commercial thickening agent (Carbopol 941) was examined and found to act in the same way. All reduced viscosity-concentration curves obtained by dilution, either with salt solutions or water, can be shifted to a single normalized reduced viscosity plot. This shift is done by using as the concentration variable the quantity  $cQ$ , where  $c$  is the polyelectrolyte concentration and  $Q$  is the swelling which the gel particles undergo in an excess of solvent at the corresponding total ionic strength of the solution of concentration  $c$ .

3600 • Problems Encountered in Measuring Trypsin Inhibitor Activity of Soy Flour. Report of a Collaborative Analysis

J. J. Rackis, J. E. McGhee, I. E. Liener,<sup>1</sup> M. L. Kakade,<sup>2</sup> and G. Puski<sup>3</sup>

(<sup>1</sup>University of Minnesota, St. Paul; <sup>2</sup>Land O'Lakes, Inc., Minneapolis, Minn.; <sup>3</sup>Central Soya Co., Inc., Chicago, Ill.)  
Cereal Sci. Today 19(11): 513-516. November 1974

A collaborative study by a joint Committee on Soybean Trypsin Inhibitor Analysis, American Association of Cereal Chemists and American Oil Chemists' Society, revealed that several factors affect both accuracy and reliability of the procedure used to determine trypsin inhibitor activity in raw and heat-treated soy flours. Benzoyl-DL-arginine-*p*-nitroanilide was the substrate used to measure antitryptic activity of the soybean samples. The relative standard deviation (RSD) between collaborators analyzing extracts prepared in their own laboratories was +48% compared with an RSD of about +5% for common extracts. Changes in the procedure that greatly improved agreement between collaborators included: Extraction with 0.01N sodium hydroxide and dilution of the extracts within narrow limits to control the level of trypsin inhibitor activity taken for analysis, and selection of conditions to eliminate cloudiness or reduction in absorbance values after reaction was terminated.

## 3601 • Computer Handling of Taste Panel Data

K. Warner, J. O. Ernst, B. K. Boundy, and C. D. Evans

Food Technol. 28(11): 42, 44-45, 47. November 1974

A system for computer handling of taste panel data was designed to replace manual transfer and calculation of results. Score sheets were modified to permit easy keypunching of data on computer cards. The main program was written to read computer cards, calculate average scores, and determine analysis of variance. Results are printed out along with input data. Five other programs were written to store the data on disc and to retrieve all, or part, of the information as needed. The few programs in use are some of many possible ones that could be used either to retrieve data from disc to analyze consistency of a taster, to collect data for training new panel members, or to determine the reliability of testing methods.

## 3602 • Milling Characteristics of Triticale

R. A. Anderson, A. C. Stringfellow, J. S. Wall,  
and E. L. Griffin, Jr.

Food Technol. 28(11): 66, 68, 70, 72, 74, 76. November 1974

Triticale is a good potential source of protein-rich supplements for food products, as well as a source of flour and starch fractions for food, feed, and industrial applications.

Several different triticale grains have been milled to provide straight grade flours. Although protein contents were in the range of most hard wheat flours, yields were somewhat lower. Byproduct fractions of milling, the shorts and the bran, had protein contents as high as 18 and 20%, respectively. Amino acid analyses indicated that the quality of protein (i.e., lysine content) was better in the shorts and bran than in the flour or the original grain. Further grinding and air classification of the flours gave yields (18-25%) of combined high-protein fractions (11-15  $\mu$  particle size) comparable to those from a hard wheat; protein contents of the fractions varied from 22 to 29%. The combined starchy fractions (18-25  $\mu$ ) amounted to about 65%, and were similar to corresponding fractions from a soft wheat. Amino acid patterns for one triticale flour and its eight air-classified fractions indicated that as particle size of the flour increased, lysine and leucine contents decreased with a corresponding increase in methionine and phenylalanine. High-quality starch can be recovered from triticale by wet processing either the grain or the flour.



- 3603\* • Starch Graft Copolymers for Water Treatment  
 Robert C. Burr, George F. Fanta, William M. Doane,  
 Charles R. Russell, and Duane A. Jones<sup>1</sup>  
 (<sup>1</sup>General Mills Chemicals, Inc., Minneapolis, Minn.)  
 Proc. Chem. Inst. Can. Flocculation and Dispersion Symp.,  
 Toronto, pp. 253-271. November 1974

Graft polymers produced by the reaction of starch with cationic, anionic, and nonionic acrylic monomers show considerable potential as flocculating agents for treatment of industrial and municipal wastewaters, for beneficiation of mineral ores, and for retention of clay in filled paper. Performance of the polymers depends on the nature of the system being treated and on the structure of the starch grafts. Percent add-on, grafting frequency, molecular weight of grafted chains, and ionic charge are important variables in starch graft polymer structure that influence performance. Effectiveness of the polymers as flocculants has been demonstrated in laboratory tests and in on-site trials. Methods of preparation and characterization of the various polymers are available.

- 3604 • Flocculating Agent-Starch Blends for Interfiber Bonding  
 and Filler Retention: Comparative Performance with  
 Cationic Starches  
 H. D. Heath, A. J. Ernst, B. T. Hofreiter, B. S. Phillips,  
 and C. R. Russell  
 Tappi 57(11): 109-111. November 1974

Additive blends, composed of a starch graft polymer flocculant and unmodified starch in varying ratios were compared with several cationic starches as wet-end additives to improve sheet strength and filler retention. Co-dispersed solutions of the flocculant and unmodified starch performed equally as well as the separately dispersed components. Co-dispersion also lessened "gumballing" tendencies of the flocculant during dispersion. The additive blends provide a wide range of sheet strength and retention combinations through adjustment of addition level and component ratio, give excellent retention of the starch component, and yield maximum suspended solids reductions. Blends should be added as close to the headbox as possible to minimize shear effects of flocs.

The cationic starches that were evaluated varied considerably in flocculating ability. Tentative cost-performance data indicate that, excepting when high orders of suspended solids reduction are required, the property combinations are more economically achieved with a very effective cationic starch than with the additive blends.

## 3605 • Biodegradable Surfactants Derived from Corn Starch

Peter E. Throckmorton,<sup>1</sup> Richard R. Egan,<sup>1</sup> David Aelony,<sup>1</sup>  
 Gayle K. Mulberry,<sup>2</sup> and Felix H. Otey  
 (<sup>1</sup>Ashland Chemical Co., Columbus, Ohio; <sup>2</sup>Hill Top Research, Inc.,  
 Miamiville, Ohio)  
 J. Amer. Oil Chem. Soc. 51(11): 486-494. November 1974

Polyol glycosides, prepared by reacting corn starch with ethylene glycol or glycerol, were used to make biodegradable surfactants. The hydroxyl sites of the glycosides were first partially polyalkoxylated with ethylene oxide or a mixture of ethylene and propylene oxides. The resulting derivatives then were reacted with various long-chain epoxides or fatty esters. A good hydrophilic-lipophilic balance in these products was achieved by controlling the number of alkoxide and aliphatic groups per anhydroglucose unit. Surface active properties of these products were destroyed rapidly by the bacteria of an activated sludge. This excellent biodegradability property was attributed to the presence of the glycoside unit.

## 3606 • Soybean Oil in Dried Egg Mixes

C. D. Evans, K. Warner, K. Boundy, G. R. List, J. C. Cowan,  
 and J. Dizikes<sup>1</sup>  
 (<sup>1</sup>Dairy Division Laboratory, AMS, USDA, Chicago, Ill.)  
 J. Amer. Oil Chem. Soc. 51(11): 509-513. November 1974

Dried egg mixes prepared commercially with hydrogenated-winterized soybean, corn, or cottonseed oils were evaluated for initial flavor and for flavor storage stability. Quality evaluations were made on products from two processing plants; flavor, color stability, and mix volumes were determined periodically during storage at 100° F. for 1 year. All mixes contained 15% of the specified oil and were air-packaged in 6-ounce laminated foil pouches.

Replicated triangle flavor tests on reconstituted dried eggs (scrambled) indicated that neither an analytical-type taste panel nor a palatability panel could distinguish between the mixes containing the different vegetable oils. All samples, regardless of oil component, deteriorated at about the same rate when stored at elevated temperatures. Minor differences in flavor scores, color indices, and mix volumes were noted in samples stored at 100° F. for 9 or 12 months.

A dried egg mix made with hydrogenated-winterized soybean oil could not be distinguished, after 4 months' aging at 100° F., from a fresh (unaged) mix made with corn oil. After 6 months' storage at 100° F. all aged mixes, regardless of the vegetable oil used in their preparation, could be distinguished from the fresh corn oil mix.

3607 • *Aspergillus flavus* Infection and Aflatoxin Production  
in Corn: Influence of Trace Elements

E. B. Lillehoj, W. J. Garcia, and M. Lambrow

Appl. Microbiol. 28(5): 763-767. November 1974

Distribution of trace element levels in corn germ fractions from kernels naturally infected with *Aspergillus flavus* and from kernels free of the fungus demonstrated an association between the presence of *A. flavus* and higher levels of metals. *A. flavus* production of aflatoxin on various autoclaved corn media showed that ground, whole corn was an excellent substrate; similar high levels of toxin were observed on full-fat corn germ, but endosperm and defatted corn germ supported reduced yields. The influence of trace elements and their availability in defatted corn germ to *A. flavus*-mediated aflatoxin biosynthesis were measured. Enrichment of the substrate with 5-10 µg. of manganese, copper, cadmium, or chromium per gram of germ increased toxin yields. Addition of lead or zinc (50-250 µg. per gram) also enhanced toxin accumulation. Aflatoxin elaboration was reduced by the addition of 25 µg. cadmium per gram or 500 µg. copper per gram of germ.

3608 • Fermentation of Feedlot Waste Filtrate by Fungi  
and Streptomycetes

B. A. Weiner and R. A. Rhodes

Appl. Microbiol. 28(5): 845-850. November 1974

The soluble and dispersed nitrogen and carbon components in a filtrate fraction of cattle feedlot waste are a potential nutrient source from which single cell protein could be produced for animal feeds. The ability of more than 200 fungi and streptomycetes to grow in this liquid was determined; these included isolates from the waste and associated sources, as well as organisms maintained in the ARS Culture Collection. Utilization of waste nutrients was measured by changes in nitrogen content and chemical oxygen demand. Only 20% of the organisms were able to grow appreciably in the filtrate. Of these, dry weight yields of mycelium varied from 0.6 to 2.7 grams per liter; from 21 to 50% of the nitrogen in the filtrates was used during growth while chemical oxygen demand levels diminished from 4 to 60%. In general, streptomycetes isolated from the feedlot used nutrients from the filtrates better than did fungi. Addition of readily available carbon sources, such as glucose or whey, significantly increased cell yields of selected organisms (sixfold) and promoted better utilization of nitrogen (two- to threefold); the effect on chemical oxygen demand varied (0 to 33% increase).



3609 • Composition of *Celastrus orbiculatus* Seed Oil

Roger W. Miller, C. R. Smith, Jr., D. Weisleder, R. Kleiman,  
and W. K. Rohwedder

Lipids 9(11): 928-936. November 1974

The seed oil of *Celastrus orbiculatus* (family Celastraceae) was re-investigated to determine whether the benzoic acid that it contains is esterified with glycerol. Unlike acetic acid, benzoic acid is not incorporated in glycerides of this oil but, instead, is esterified with two sesquiterpenoid triols of the empirical formula  $C_{15}H_{26}O_4$ . *trans*-Cinnamic acid also is esterified with these triols. Acetic acid is a component of these nonglyceride esters, as well as of the triglycerides. We found no evidence for the occurrence of formic acid in this oil. By countercurrent fractionation, we found that this oil contains 8% "ordinary" triglycerides, 59% monoacetotriglycerides, and 33% nonglyceride substances.

## 3610 • Rapid Thermogravimetric Estimation of Oil Stability

H. J. Nieschlag, J. W. Hagemann, J. A. Rothfus, and D. L. Smith<sup>1</sup>  
(<sup>1</sup>Trane Company, La Crosse, Wis.)

Anal. Chem. 46(14): 2215-2217. December 1974

A commercially available thermogravimetric system was used to estimate quickly relative keeping qualities of crambe oil samples. Instrumental components consisted of a sensitive electrobalance, a strip-chart recorder, and a small electric furnace. Changes in sample weight were recorded as the sample temperature was programmed to increase at a rate of 5° C. per minute in a pure oxygen environment. The method should be useful for predicting the resistance to oxidation of other vegetable oils.

## 3611 • Bleaching of Kenaf Soda Pulps

Naiyana Niyomwan, T. F. Clark, and R. L. Cunningham

Tappi CA Report No. 53, "Non-Wood Plant Fiber Pulping--Progress  
Report No. 5," pp. 73-77. Atlanta, Ga. September 1974

Soda pulps from wet-cleaned bark, woody core, and unfractionated kenaf were treated with various combinations of chlorine and chlorine dioxide to explore influence of conditions on hot alkali solubility and cupri-ethylenediamine disperse viscosity. A 65% application of the chlorine demand in the first bleach stage appears preferable to a 50% application. Similarly, 0.2% chlorine dioxide gave lower alkali extractability than 0.1%. When the investigation was extended to a 4-stage sequence of chlorination including use of chlorine dioxide, extraction, treatment with sodium hypochlorite, and a final chlorine dioxide stage, extensive degradation occurred after the second stage. Further study is needed to determine preferred conditions in stages 3 and 4.

- 3612 • Linseed Oil Formulations as Curing and Antiscaling Compounds for Concrete  
 Cecil H. Best,<sup>1</sup> James F. Crary,<sup>1</sup> Lyle E. Gast, and William L. Kubie  
 (<sup>1</sup>Kansas State University, Manhattan)  
 Transp. Res. Rec. 504: 63-70. 1974

An extensive testing program was undertaken to determine the effectiveness of linseed oil in mineral spirits both as a curing compound and as an antiscaling compound for inadequately air-entrained portland cement concrete. The testing program is discussed in light of the immediate and residual effectiveness and the value of such linseed oil formulation treatments.

- 3613 • Paper Strengthening by Starch Xanthate-Alkyl Diepoxide Adducts  
 G. G. Maher, C. R. Russell, and C. E. Rist  
 Staerke 26(11): 386-389. November 1974

The reaction between starch xanthate and alkyl diepoxide formed either gels in concentrated solution (6-8%) or turbid suspensions in dilute solution (0.1-1.0%); gelling varied with the nature of the epoxide. When either the gel or suspension was dispersed and added to a wood pulp suspension, strength characteristics of paper products improved. When the reaction was conducted in the presence of paper furnish, handsheets containing a 2.5% additive level based on fiber content had burst, folding endurance, and wet and dry breaking length values 1.6, 4.6, 4.2 and 1.4 times, respectively, those of control papers. Improvement in properties was somewhat independent of the xanthate's degree of substitution but dependent on the reaction time (either separate from or in presence of fiber) and the order of addition of epoxide and xanthate.

- 3614 • A Polymeric Absorbent Seeks Problems to Solve  
 George F. Fanta, M. Ollidene Weaver, and William M. Doane  
 Chem. Technol. 1974: 675-676. November 1974

Polymers, which are useful as absorbents for aqueous fluids, are prepared by drying the alkaline saponification product of a starch-polyacrylonitrile graft copolymer. No crosslinking reagents are necessary to achieve the required insolubility, and crosslinking apparently occurs on drying by some as yet unknown mechanism. Graft copolymer absorbents take up several hundred times their weight of deionized water and retain the absorbed water under pressure. The cost-to-make for graft copolymer absorbents is estimated at 21-25 cents per pound for unpurified products.

3615 • Preparation and Film Properties of Oils Conjugated by Dimsyl Salts

W. J. DeJarlais, L. E. Gast, and G. E. McManis

J. Amer. Oil Chem. Soc. 51(12): 551-553. December 1974

A study was made of the conjugation of soybean and linseed oils with dimsylsodium and dimsylpotassium as catalysts. Dimsylpotassium had markedly greater catalytic activity than dimsylsodium. The most effective cosolvent used with dimethyl sulfoxide for conjugation at room temperature was tetrahydrofuran. Bis(2-ethoxyethyl) ether was less effective as a cosolvent than tetrahydrofuran at room temperature but was nearly as effective at 50° C. An adduct with maleic anhydride was prepared from the conjugated linseed oil under mild conditions. Drying characteristics of the conjugated linseed oil were also investigated. Baked conjugated linseed oil films were comparable to baked dehydrated castor oil films.

3616 • Cationic Starch-Polyacrylonitrile Graft Copolymer Latexes

L. A. Gugliemelli, C. L. Swanson, F. L. Baker, W. M. Doane, and C. R. Russell

J. Polym. Sci. 12(11): 2683-2692. November 1974

Acrylonitrile (AN) was graft-polymerized onto gelatinized cationic starch (CS) possessing diethylaminoethyl ether groups by cerium(IV) initiation to give stable latex-like copolymer dispersions. Dispersions of the latex copolymers, having up to 50% grafted polyacrylonitrile (PAN), air- and heat-dry on glass to clear, adhesive films. Sonification of up to 8% dispersions at 20 Khz reduced their viscosities from 1500-3000 cP to 15-40 cP. Scanning electron microscopy revealed that both nonsonified and sonified dispersions consist of ball-like particles measuring about 0.05-0.15  $\mu$  in diameter when dry. The films are formed by coalescence of these particles. The degree to which AN grafts onto CS at ambient temperature is related to the nitrogen content of CS, gelatinization time of CS at 95° C., sequence of AN and cerium(IV) addition, concentration of cerium(IV), concentration of AN, and severity of reaction agitation. Number-average molecular weight values of PAN were about  $10^6$  when grafting was conducted under stirring and about  $5 \times 10^5$  when conducted under shaking action.

3617\* • Nonwood Cellulosic Raw Materials

Dwight L. Miller

In "New Resources from the Sun," Proc. 34th Annu. Conf. The Chemurgic Council, Washington, D.C., Nov. 1-2, 1973. [1974]



Nonwood cellulosic raw materials can be made available in the United States and throughout the world in the form of fiber crops, as agricultural byproducts, and as animal residues. The potential annual quantities of these renewable materials represent billions of tons. To date their commercial use has been minor, primarily because of economics. For example, wood has been readily available and is less expensive to use in the manufacture of paper and paperboard--the traditional market for cellulosic raw materials.

Today, there is a developing wood shortage, new energy raw materials are urgently needed, and pollution considerations necessitate that environmental requirements be satisfied. Consequently, nonwood cellulosic raw materials are receiving worldwide attention.

### 3618\* • Carbohydrates as a Renewable Chemical Resource

R. J. Dimler

In "New Resources from the Sun," Proc. 34th Annu. Conf. The Chemurgic Council, Washington, D.C., Nov. 1-2, 1973. [1974]

Formation of carbohydrates through photosynthesis is the primary pathway for capture and storage of energy from the sun. This stored energy may be released by metabolism or combustion of the carbohydrates. Alternatively, carbohydrates may be transformed to other products. In living systems they are converted to lipids, proteins, and many other organic compounds. Industrially, carbohydrates are subjected to chemical transformations yielding other useful products. In this instance, the carbohydrates serve as a chemical resource or as the primary raw material.

A few examples indicate that carbohydrates can meet new needs and offer some help in solving pressing problems of today and years ahead. The two focal points of concern are conserving fossil fuels and minimizing pollution.

### 3619\* • Citrinin Mycotoxicosis in Beagle Dogs

W. W. Carlton,<sup>1</sup> G. Sansing, G. M. Szczech,<sup>1</sup> and J. Tuite<sup>1</sup>  
(<sup>1</sup>Purdue University, West Lafayette, Ind.)

Food Cosmet. Toxicol. 12(4): 479-490. August 1974

Three trials were completed in which young beagle dogs were either fed a citrinin-containing culture of *Penicillium citrinum* (Trial 1) or were administered pure citrinin either ip (Trial 2) or orally (Trial 3). Dogs fed the fungal culture and those given 20 or 40 mg. pure citrinin/kg. body weight developed renal disease. Dogs given 2.5 and 5 mg./kg. remained clinically normal and without renal lesions. Clinicopathological evidence of renal damage included a rise in blood urea nitrogen, glucosuria,

proteinuria, lowered urinary specific gravity, increased urinary activities of lactic dehydrogenase, glutamic-oxalacetic transaminase and isocitric dehydrogenase and the presence of numerous necrotic renal tubular epithelial cells in the urinary sediment. Emesis and intestinal intussusception occurred in the dogs given 20 or 40 mg./kg. ip. Renal lesions consisted of degeneration and necrosis of the tubular epithelium, most prominently in the thick segment of Henle and in the distal convoluted tubules.

- 3620\* • Family VII. *Streptomycetaceae* Waksman and Henrici 1943, 339;  
Genus I. *Streptomyces* Waksman and Henrici 1943, 339;  
Genus III. *Sporichthya* Lechevalier, Lechevalier and Holbert  
1968, 279; Genus IV. *Microellobosporia* Cross, Lechevalier  
and Lechevalier 1963, 422  
T. G. Pridham and H. D. Tresner<sup>1</sup>  
(<sup>1</sup>Lederle Laboratories, American Cyanamid Co., Pearl River, N.Y.)  
In "Bergey's Manual of Determinative Bacteriology," 8th ed.,  
eds. R. E. Buchanan and N. E. Gibbons, pp. 744-748; 748-829;  
842-843; 843-845. Baltimore, Md. 1974

A contemporary summation and evaluation of the systematics of the family *Streptomycetaceae* and three of its genera--*Streptomyces*, *Sporichthya*, and *Microellobosporia* are presented. Descriptions for each validly published and legitimate species of these genera proposed through June 1967 are presented and documented. Descriptions are based on criteria recognized as more significant than those used in past editions of the Manual. These criteria include: ornamentation of spore walls or sheaths, morphology of spore chains, ability to form dark diffusible pigments, color of aerial mycelium, carbon-utilization patterns, and identity of antibiotic compounds produced. Considerable emphasis is placed on the type strain concept which allows more precise documentation of characteristics and of strain histories. Some attention is given to genetic aspects such as moles percent guanine plus cytosine content of DNA.

- 3621 • New Coatings from Chemically Modified Linseed Oil and  
Hydroxyl-Bearing Butadiene and Acrylic Resins  
T. H. Khoe and L. E. Gast  
J. Paint Technol. 46(598): 53-55. November 1974

New vehicles for coatings were prepared from polybutadiene, butadiene-styrene, butadiene-acrylonitrile, and acrylic resins with pendent hydroxyl groups on the polymer backbones, and either hydroformylated or maleated linseed oils. Most of these resins showed better film properties than linseed alkyd resins. The films air-dried faster and had better hardness; xylene resistance and acid resistance were excellent. The resins from maleated linseed oil may have potential as water-dispersible coatings.

- 3622 • Gel Sheets Produced by Hydration of Films from the Potassium Salt of Hydrolyzed Starch-Polyacrylonitrile Graft Copolymer  
M. O. Weaver, E. B. Bagley, G. F. Fanta, and W. M. Doane  
Appl. Polym. Symp. No. 25: 97-102. 1974

Hydrolyzed starch-polyacrylonitrile (H-SPAN) graft copolymer has an unusual film-forming property. Viscous aqueous dispersions formed by addition of alkali to H-SPAN (to a pH >4.5) produce dry, self-supporting films. These films not only remain intact in water (except under conditions of high shear), but also rapidly imbibe water up to 300 times their initial weight while retaining their gross shape. Film integrity in water is maintained over a wide temperature and pH range although the amount imbibed depends strongly on the presence of monovalent, as well as polyvalent, ions in the solution.

- 3623 • Ultracentrifugation and Binding Studies of Acid-Sensitive Soybean Proteins  
R. L. Anderson  
Cereal Chem. 51(6): 707-717. November-December 1974

A fraction of the soybean protein that precipitates at pH 4.5 remains insoluble after neutralization. According to an assay developed, this acid-sensitive fraction (ASF) accounts for 25 to 30% of the water-extractable proteins. The ASF has been precipitated from an aqueous extract of soybean meal with  $(\text{NH}_4)_2\text{SO}_4$  at pH 7.0 to yield preparations containing up to 67% ASF. Samples that contain ASF are tan or brown, and color intensity increases in proportion to the amount of ASF present. Difference spectroscopy of equilibrium dialysis samples indicates that ASF binds nonprotein material from 2 to 10 times more tightly than do the other soybean proteins. The 7S protein which lacks the ability to form a dimer at 0.1 ionic strength appears to function prominently in acid denaturation of ASF.

- 3624 • Heavy Metals in Food Products from Corn  
W. J. Garcia, C. W. Blessin, and G. E. Inglett  
Cereal Chem. 51(6): 779-787. November-December 1974

Concentrations of seven heavy metals (zinc, manganese, copper, lead, cadmium, chromium, and mercury) were determined for a wide variety of consumer-oriented corn products: milled fractions, prepared breakfast and snack foods, canned and frozen sweet corn items, syrups, oil, and kernel popcorn. Samples were decomposed by wet-oxidation, and six of the elements were determined by flame atomic absorption. Mercury was measured by a nonflame atomic absorption technique. Metal content ranged from a high of more than 200  $\gamma$  zinc per gram in a defatted corn germ flour



to a low of less than 0.001  $\gamma$  mercury per gram in some products. The possible introduction of heavy metals into finished corn products by industrial processing was studied by comparing concentrations in finished products with previously determined heavy metal concentration in whole kernel corn.

- 3625 • Heavy Metals in Whole Kernel Dent Corn Determined by Atomic Absorption  
W. J. Garcia, C. W. Blessin, and G. E. Inglett  
Cereal Chem. 51(6): 788-797. November-December 1974

Whole kernel corn was wet-ashed with nitric and perchloric acids, and the resultant salts were dissolved in dilute acid. Concentration levels in corn samples were determined for zinc, manganese, copper, lead, cadmium, and chromium by flame atomic absorption. Because this technique is not sensitive enough to measure the small quantities of mercury present, an oxidation procedure was developed that decomposed organic material in corn at a temperature of 70° C. The mercury was retained effectively in an aqua regia solution until the elemental mercury was de-emanated for measurement of the vapor by a nonflame atomic absorption technique. The aqua regia solution ensured that mercury was completely solubilized. In addition, mercury standards prepared in a 10% aqua regia medium have proved to be stable at low concentrations for extended periods. Mean concentration values for the seven metals studied in 11 different corn samples ranged from a high of 23  $\gamma$  per gram for zinc to a low of approximately 0.0024  $\gamma$  per gram for mercury.

- 3626 • Microbiology of Corn and Dry Milled Corn Products  
R. J. Bothast, R. F. Rogers, and C. W. Hesseltine  
Cereal Chem. 51(6): 829-838. November-December 1974

A microbiological survey was conducted on corn, grits, and flour from three mills in the Kansas-Nebraska-Oklahoma area. Duplicate samples were taken 1 week apart in November, February, May, and August. The frequency of mold infection for whole-corn kernels ranged from 55 to 77% and was highest in February. Species of *Fusarium* and *Penicillium* occurred in approximately 50% of the kernels examined. In addition, *Aspergillus flavus*, other species of *Aspergillus*, *Nigrospora*, *Alternaria*, *Helminthosporium*, *Trichoderma*, *Chaetomium*, and mucoraceous fungi were identified. Counts per gram of sample were determined for total aerobic bacteria, psychrotrophic bacteria, total coliforms, fecal streptococci, total thermophilic aerobic spores, flat-sour spores, total molds, *A. flavus*, and actinomycetes. Microbial counts were usually lowest in grits, followed by whole corn, and then flour. All samples were negative for salmonellae and only a few contained low levels of fecal coliforms, *Clostridium perfringens* and coagulase-positive staphylococci.

## REPUBLICATIONS

- 3406 • Water-Insoluble Starch Xanthate. Preparation and Use  
in Heavy Metal Recovery  
[R. E. Wing]  
North. Reg. Res. Lab., U.S. Agr. Res. Serv., CA-NRRL-41 (Rev.),  
4 pp. August 1974 [Processed]

This is a revised version of the Correspondence Aid originally issued in November 1973.

## UNOFFICIAL PUBLICATIONS

Listing of publications and patents of the Northern Regional Research Laboratory would not be complete without including some unofficial publications. These are writings by members of the Northern Laboratory staff, and, although written from previously published official material, are of a public service value from the standpoint of review and updating of the literature. Reprints are not available at the Northern Regional Research Laboratory for distribution.

### Deceptive Labeling and Adulterated Honey

Lloyd A. Lindenfelser

Beeline 3(7): 1-5. July 1974

Comments on "Influence of Shearing History on the Properties of Polymer Melts. I," by Z. K. Walczak, J. Appl. Polym. Sci. 17: 153 (1973)

E. B. Bagley

J. Appl. Polym. Sci. 18(8): 2533-2537. August 1974

## CONTRACT AND GRANT RESEARCH PUBLICATIONS

[Report of research done by an outside agency under a grant from the U.S. Department of Agriculture and supervised by the Northern Regional Research Laboratory.]

- 140-G\* • A New Method of Acetonation. Synthesis of 4,6-O-Isopropylidene-D-glucopyranose  
Melville L. Wolfrom, Atmanand B. Diwadkar, Jacques Gelas, and Derek Horton  
The Ohio State University, Columbus  
Carbohyd. Res. 35: 87-96. July 1974

[Report of research work supported with funds provided by the U.S. Department of Agriculture under the authority of U.S. Public Law 480, 83rd Congress, and sponsored by the Northern Regional Research Laboratory.]

- 361-F • Hydrosilylation of Long Chain Unsaturated Fatty Acid Esters  
Nasser Saghian and David Gertner  
The Hebrew University, Jerusalem, Israel  
J. Amer. Oil Chem. Soc. 51(8): 363-367. August 1974



July-December 1974

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## PATENTS

[These patents are assigned to the Secretary of Agriculture.  
Copies of patents may be purchased (50 cents each) from the  
Commissioner of Patents, U.S. Patent Office, Washington, D.C.  
20231. Order by number, do not send stamps.]

### Flame-Retardant Polyurethane Foams

Felix H. Otey, Richard P. Westhoff, and Charles L. Mehlretter  
U.S. Patent 3,823,132. July 9, 1974

Highly flame-resistant rigid foams are obtained by the use of novel  
halogen-containing polyols in the polyurethane synthesis.

### Polysaccharide-Containing Elastomers

Thomas P. Abbott  
U.S. Patent 3,830,762. August 20, 1974

Elastomer compositions prepared by an improved polysaccharide-elastomer  
coprecipitation method are storage-stable powders which are capable of  
being formed into vulcanized rubber articles by injection molding or  
other similar methods without prior high shear mixing. Such vulcanizates  
have the improved properties previously associated only with extrusion-  
processed polysaccharide-reinforced rubbers.

### Method of Incorporating Water-Soluble Epoxypropyl Starch into Paper

Robert E. Wing and William M. Doane  
U.S. Patent 3,834,984. September 10, 1974

A process is disclosed for preparing paper having incorporated therein an  
epoxypropyl starch. At epoxypropyl D.S. of up to .09 the compounds are  
water soluble and increase both wet and dry strength of paper at a 1% level  
of addition.

## Nickel/Copper Chromite Catalysts for Hydrogenating Edible Oils

Karl J. Moulton and Robert E. Beal

U.S. Patent 3,856,710. December 24, 1974

Vegetable oils are hydrogenated with mixed copper and nickel catalyst compositions. Oils with linolenate contents of about 7% are partially hydrogenated to form liquid oils containing no linolenate with selectivities only slightly lower than those with copper catalysts alone and with significantly accelerated hydrogenation rates.

## LICENSING OF PATENTS

Many inventions and discoveries of the Northern Laboratory are covered by patents assigned to the Secretary of Agriculture.

Assigned patents are available for use by business and industry under either exclusive or non-exclusive licenses. Conditions

applicable to the granting of licenses are set forth in the Federal Register, May 14, 1970 [35(94): 7493-7495]. Further information can be obtained from the Administrator, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. 20250.

The Northern Regional Research Laboratory is part of the Agricultural Research Service of the U.S. Department of Agriculture. Congress in 1938 authorized four regional laboratories to conduct broad and complex investigations in the field of chemistry and related physical sciences to expand and improve the marketability of agricultural commodities. A fifth laboratory was completed in 1969 at Athens, Georgia. The addresses and commodities covered are:

<u>Laboratory</u>	<u>Principal Fields of Research</u>
Eastern Regional Research Laboratory 600 East Mermaid Lane Philadelphia, Pennsylvania 19118	Animal fats; dairy products; deciduous fruits; hides and leather; maple sap and sirup; meat and meat byproducts; potatoes and other vegetables.
Northern Regional Research Laboratory 1815 North University Street Peoria, Illinois 61604	Cereal grains: corn, wheat, grain sorghum, barley, and oats; oilseeds: soybean, flaxseed, and erucic acid-containing oilseeds; and new crops.
Richard B. Russell Agricultural Research Center P.O. Box 5677 Athens, Georgia 30604	Southeastern poultry, fruits, and vegetables; pecans and peanuts; forages and feeds; sunflower as an oilseed; pork; and tobacco.
Southern Regional Research Laboratory P.O. Box 19687 New Orleans, Louisiana 70179	Cotton and cottonseed; peanuts; rice; sweet potatoes; and sugarcane.
Western Regional Research Laboratory Berkeley, California 94710	Western fruits, nuts, vegetables, oilseeds, and rice; poultry products; forage crops; wheat and barley; wool and mohair; dry beans and peas; castor; and safflower.







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